

ABSTRACT OF THE DISCLOSURE

The etching of a sacrificial silicon portion in a microstructure such as a microelectromechanical structure by the use of etchant gases that are noble gas fluorides or halogen fluorides is performed with greater selectivity toward the silicon portion relative to other portions of the microstructure by slowing the etch rate. The etch rate is preferably 30 $\mu\text{m/hr}$ or less, and can be 3 $\mu\text{m/hr}$ or even less. The selectivity is also improved by the addition of non-etchant gaseous additives to the etchant gas. Preferably the non-etchant gaseous additives that have a molar-averaged formula weight that is below that of molecular nitrogen offer significant advantages over gaseous additives of higher formula weights by causing completion of the etch in a shorter period of time while still achieving the same improvement in selectivity. The etch process is also enhanced by the ability to accurately determine the end point of the removal step. A vapor phase etchant is used to remove a material that has been deposited on a substrate, with or without other deposited structure thereon. By creating an impedance at the exit of an etching chamber (or downstream thereof), as the vapor phase etchant passes from the etching chamber, a gaseous product of the etching reaction is monitored, and the end point of the removal process can be determined. The vapor phase etching process can be flow through, a combination of flow through and pulse, or recirculated back to the etching chamber. Also, the etch selectivity can be improved by doping the sacrificial material.